RECEIVED - SWO AIR POLLUTION CONTROL
MAY 11 1989

RAMCON
ENVIRONMENTAL CORPORATION

May 1, 1989

Mr. Paul Prottengeier
Valley Asphalt Corporation
11641 Mosteller Road
Cincinnati, OH 45421

Re: Particulate Emissions Test: Sharonville, Ohio Plant #9

Dear Mr. Prottengeier:

Enclosed you will find four copies of our report on the particulate emissions test we conducted at your plant. Based on our test results, the average actual emissions in pounds per hour of the three test runs is below the allowable emissions limit set by the State of Ohio. Therefore, the plant is operating in compliance with State Standards.

You will need to sign the report covers and send two copies to:

Mr. Lee Gruber
Southwestern Ohio A.P.C. Agency
1675 Gest Street
Cincinnati, OH 45204

We certainly have enjoyed working with you. Please let us know if we can be of further assistance.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000 FAX 901-458-3868

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 1431400140 P902

FACILITY NAME Valley Asphalt (Sharonville)

SOURCE DESCRIPTION (OR SCC CODE) Batch mix asphalt plant

CONTROL EQUIPMENT Baghouse (Fabric Filter)

DATE(S) OF TEST 4/19/89

FINAL TEST REPORT RECEIVED ON 5/11/89

POLLUTANT(S) TESTED Particulates (all sizes)

TEST METHOD U.S. EPA Reference Methods 1-5

TEST FIRM Ramcon Environmental Corporation

EMISSION RATES*:

ACTUAL (lb(s)/hr) 21.9 #/Hr. ALLOWABLE** 60.5 #/hr.

OPERATING RATES*:

DURING TEST** 216 tons/hr. MAXIMUM** 240 tons/hr.

EMISSION FACTOR***

COMMENTS:

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE;

[X] AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

[ ] AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

June 15, 1989
DATE OF REVIEW

Lee R. Gruber/Ron Kolde
REVIEWED BY

* BASED ON 3 RUN AVERAGE
** SPECIFY APPLICABLE UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

OBSERVER'S REPORT
PARTICULATE TESTING (all sizes)
VALLEY ASPHALT PLANT
SHARONVILLE, OHIO

Conducted on 4/19/89
P/N: 1431400140 P902

Test firm: Ramcon Environmental Corp.
Memphis, Tennessee

By: Lee R. Gruber, Air Quality Engineer
6/13/89

SOUTHWESTERN OHIO AIR POLLUTION CONTROL AGENCY

Testing for particulate emissions (all sizes) took place on 4/19/89 at Valley Asphalt on Mosteller Road. The process is a batch mix asphalt plant, rated at 240 tph. The emission limit for particulates is 60.96 #/hr. set by OAC rule 3745-17-11. Visible emissions are limited to less than 20% opacity. The PTO was issued 10/26/87.

Test results showed an average emission rate for particulates of 21.9 #/Hr. That is 36% of the allowable rate.

Asphalt throughput was 216 tph during testing. That is 90% of the maximum rate.

Throughput was verified by visual count of the trucks and production ticket records.

The baghouse operated at 3.34 inches H_2O pressure drop. The bags are pulsed every 80 seconds for the duration cycle.

Visible emissions averaged 5% opacity from the stack. The plume is wet. No fugitive emissions were seen from the hoppers or conveyors.

U.S. EPA Reference Methods 1-5 were utilized for testing. Sampling location and ports were correctly placed. Quality assurance measures included equipment leak checks (DGM, and pitot) and sample recoveries were observed.

Calibrations of sampling equipment were included in the report. Emission rate calculations and moisture content were checked and found correct. A cyclonic flow check was conducted and the angle of flow was less than 10°.

Stack parameters were 35043 dscfm volumetric flow at 212°F and 23.48% moisture.

Two asphalt runs of 404 mix and one 301 mix were tested. No recycle was run, only virgin material, which represents worst case emissions (40% sand and 6% asphalt).

The plant recently replaced the deflector shield inside the baghouse (it had eroded and caused bypassing of a portion of the bags).

We recommend spot inspections to see that the maintenance schedule is continued. Future testing should be arranged as needed to verify compliance. An inspector should note frequency of baghouse air pulses (every 5 seconds per row).

In conclusion, the testing demonstrated that the source appeared to be in compliance with the emission limit of 60.5 #/hr.

Prepared by: R. J. Kolde

file

HAMILTON COUNTY

INTERDEPARTMENTAL CORRESPONDENCE

TO RES/JES/FES/JWD/File

FROM Lee Gruber

AT

SUBJECT Valley Asphalt

DATE March 30, 1989

A pretest meeting was held with Dan Thomas of Valley Asphalt Plant #9 on Mosteller Road on 3/30/89.

We discussed that the maximum design throughput of 240 TPH must be achieved during testing or retesting or limited permitable throughout could occur. They have three holding tanks of 228 ton capacity for product that they can fill to hold product for a few days.

They will run 404 or 301 mix for the test with virgin (no recycle) material. The kiln burner will be gas fired. There are scales to weigh product that goes to trucks or holding tanks. The tanks have a tonnage fill and usage accumulator.

The sample ports were readily accessable. They are correctly located for adequate sampling.

The baghouse pressure drop is usually near 3". A low of 2" to high of 6" occurs. There are 13 rows of bags on fixed interval/duration pulsing.

The stack base damper will be held wide open to prevent cyclonic flow.

We will call the day before the test to see if there are enough scheduled jobs and dry weather to test.

RAMCON
ENVIRONMENTAL CORPORATION

May 1, 1989

Mr. Paul Prottengeier
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11641 Mosteller Road
Cincinnati, OH 45421

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TABLE OF CONTENTS

I. INTRODUCTION

On April 19, 1989, personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Valley Asphalt's Barber-Greene batch mix asphalt plant located in Sharonville, Ohio. RAMCON personnel conducting the test were Dave Armstrong, Team Leader, and David Bailey. Kim Rea was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Armstrong and Ms. Rea.

The purpose of the test was to determine if the rate of particulate emissions from this plant's baghouse is below or equal to the allowable emissions limit set by the State of Ohio.

II. TEST RESULTS

Table I summarizes the test results. The allowable emissions limitation for the State of Ohio are specified in this plant's permit (Source #14314001408P902). The allowable emissions are computed by the formula $E = (55\ p^{.11}) - 40$, where E = allowable emissions in pounds per hour and P = process weight in tons per hour. For this plant, the average production rate was 239 tons per hour, which computes an average allowable emission rate of 60.5 lbs/hr.

Mr. Lee Gruber of Southwester Ohio's Air Pollution Control Agency observed the testing conducted by RAMCON.

TABLE I

SUMMARY OF TEST RESULTS

April 19, 1989

Allowable Emissions: 60.5 lbs/hr

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	11:40 to 12:59	0.0896 gr/DSCF	93.6%	25.9 lbs/hr
2	13:58 to 15:01	0.0588 gr/DSCF	93.7%	18.1 lbs/hr
3	15:55 to 16:58	0.0710 gr/DSCF	97.7%	21.6 lbs/hr
	Average:	0.0731 gr/DSCF		21.9 lbs/hr

On the basis of these test results, the average actual pounds per hour of emissions on the three test runs was below the allowable emissions limitation set by the State of Ohio. Therefore, the plant is operating in compliance with State Standards.

III. TEST PROCEDURES

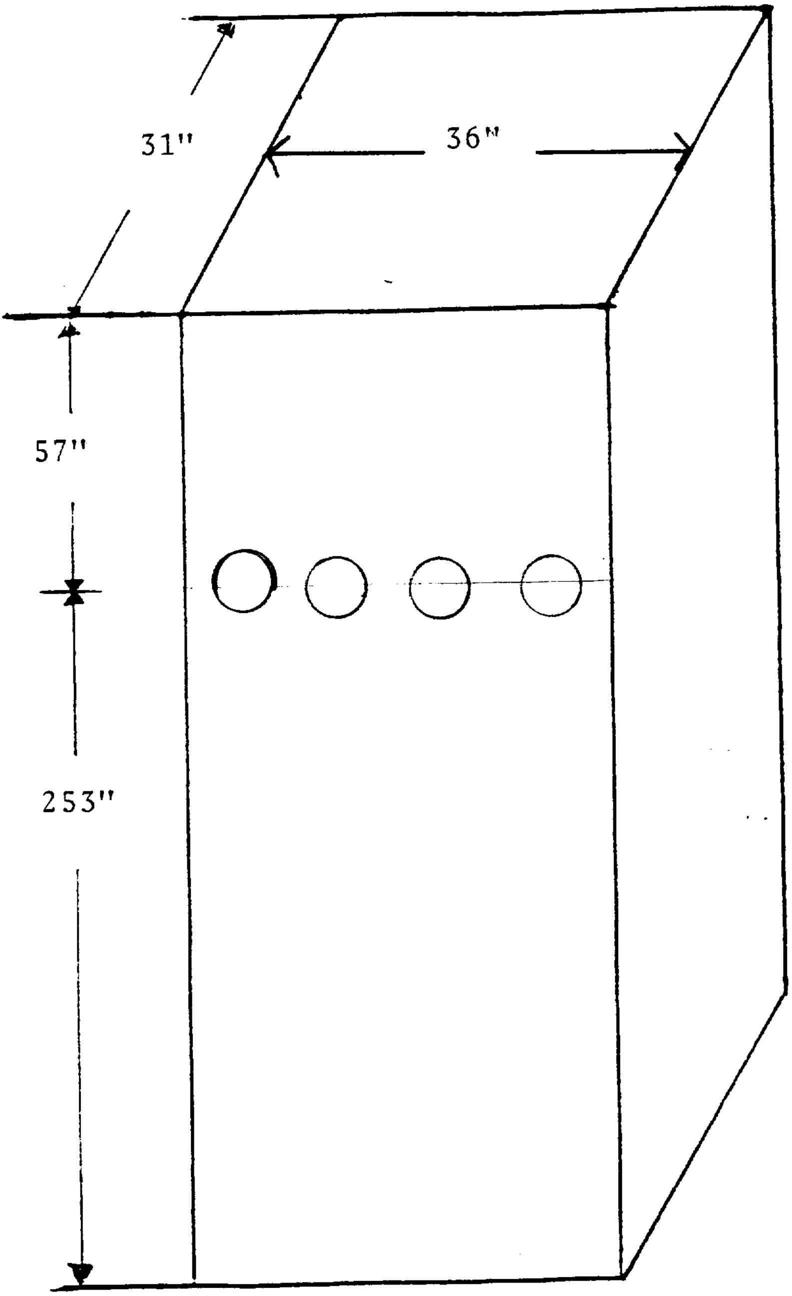
A. Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

B. Problems Encountered: No problems were encountered that affected testing.

C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 31" x 36" with an equivalent diameter of 33.3". Four sampling ports were placed 57" down (1.7 diameters upstream) from the top of the stack and 253" up (7.6 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 9.0" centers. The two outside ports are 4.5" from the side walls of the stack. Twenty points were sampled, five through each port for three minutes each.

Points on a Diameter	Probe Mark
1	*12.1"
2	18.3"
3	24.5"
4	30.7"
5	36.9"

*Measurements include a 9" standoff.



IV. THE SOURCE

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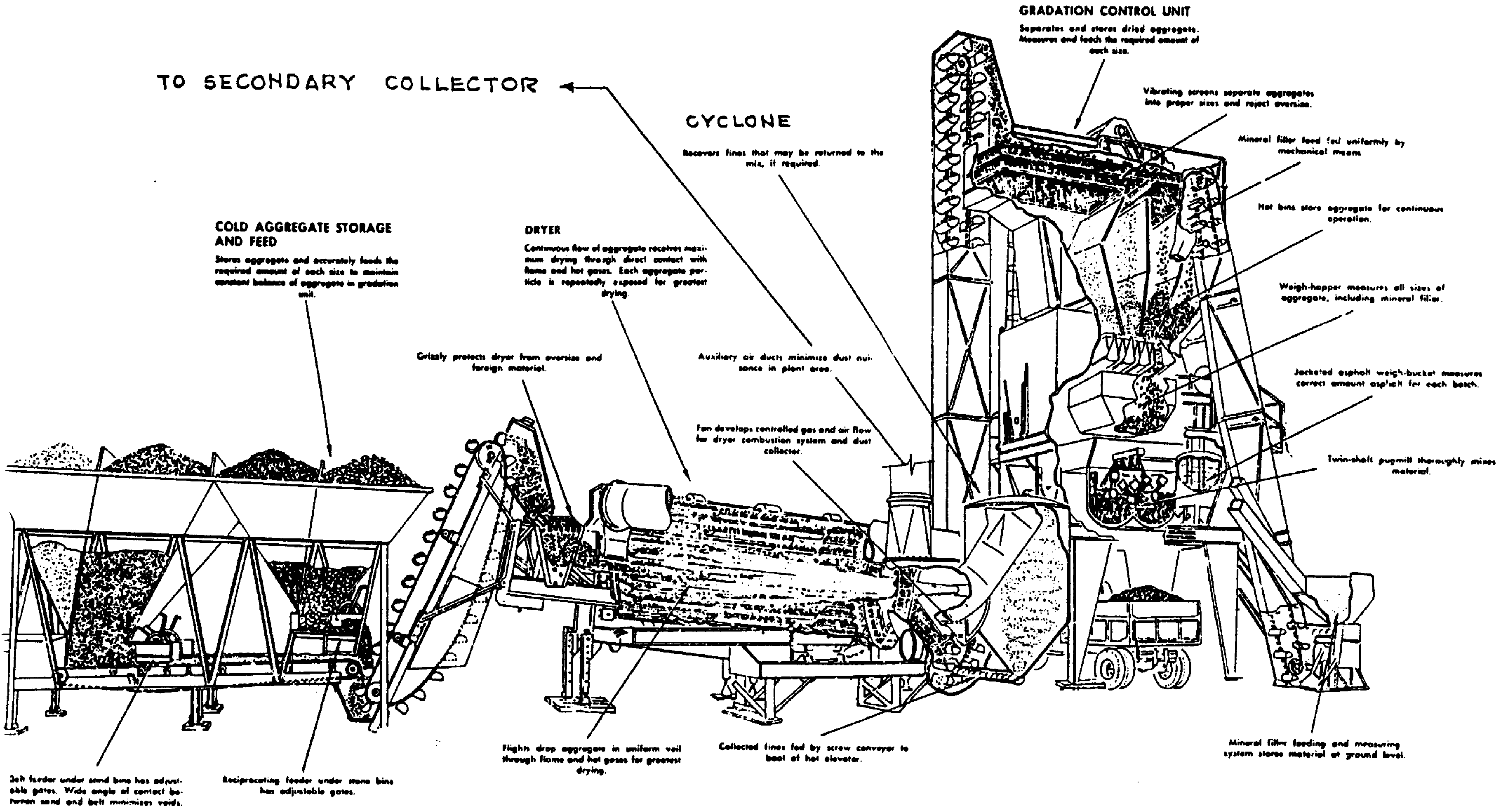
Valley Asphalt (Plant #9) employs a Simplicity batch mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the mixture together. After the hot asphalt mix is manufactured at the plant, it is transported to the location where it is to be applied. The hot asphalt mix is spread evenly over the surface with a paver then compacted with a heavy roller to produce the final product.

The following to a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into four separate bins which in turn feed a common continuous conveyor. The aggregate is dispensed from the bins in accordance with the desired formulation onto the cold feed system conveyor, to an inclined weigh conveyor, then to a rotating drum for continuous mixing and drying at approximately 300°F. The dried aggregate is pulled by a bucket elevator to the top of a gradation control unit which separates and stores the aggregate by size. The required amount of each aggregate is dispensed into a weigh-hopper and from there into a pugmill where the hot liquid asphalt pavement is mixed thoroughly with the aggregate. The hot asphalt mix is then discharged from the storage silo through a slide gate into waiting dump trucks which transports the material to a final destination for spreading. The rated capacity of the plant will vary with each aggregate mix and moisture content with a 5% surface moisture removal.

The mixer uses a burner fired with natural gas to heat air to dry the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner, the air passes through a baghouse. The baghouse is manufactured by Standard Havens. The exhaust gases are drawn through the baghouse and discharged to the atmosphere through the stack. The design pressure drop across the tube sheet is 2 - 6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the drum mixer.

Figure 4-1

ASPHALT BATCH MIX PLANT - AN EXPLODED VIEW



(5)

Source: Asphalt Plant Manual, The Asphalt Institute, 1967

S.ze of Bags 6" X 9'

(6)

DATA SUMMARY

Plant

1. Manufacturer of plant Barber Greene.
2. Designed maximum operating capacity 240 TPH @ ____% moisture.
3. Actual operation rate 238 TPH @ 5.5% moisture.
4. Startup date 3/21/89.
5. Type of fuel used in dryer Natural Gas.
6. Quanity of fuel consumption ________.

Aggregate

7. Name/type of mix ________.
8. Percent asphalt in mix ________%.
9. Temperature of asphalt ________.
10. Sieve/Screening analysis: % Passing;

2"		3/8"		#	
1"	29%	#		#	
9/16"	19%	#		#200	

Sand 203 35%

Baghouse

11. Manufacturer Standard Havens Alpha Mark I
12. No. of bags 546. Type of bags ________.
13. Air to cloth ratio ________. Designed ACFM ________.
14. Square feet of bags ________.
15. Type of cleaning; pulse jet ✓, reverse air ____, plenum pulse ________, other ________.
16. Cleaning cycle time 1/60.
17. Interval between cleaning cycle 7.
18. Pressure drop across baghouse 3 To 4 psi.
19. Pulse pressure on cleaning cycle 120 psi.

COMPANY NAME Valley Asphalt Corp DATE 4/19/89

COMPANY REPRESENTATIVE ________

Form #REC-03

PLANT DATA

COMPANY NAME Valley Asphalt Corp.

COMPANY REP. Dan Thomas DATE PHONE # 771-0820

DATA SOURCE

PLANT LOCATION SHaronVille OH

PLANT MFG. BaRBeR Greene PLANT MODEL # RE 82 X101 PLANT TYPE Batch

MIX SPECIFICATION # 404 + 301 OIL SPECIFICATION # Natural Gas A.C 20

Time 24 Hour	__ Fuel Oil __ Nat. Gas ✓ Propane __ Coal __	Burner Setting	Avg = 239.0 TPH During Test Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi __ Baghouse Pressure Drop Inches Water
		1st	Test 404	mat			
11:35		76	67.9		4.1	356	3.60
11:50		97	49.0		3.0	331	3.60
12:05		97	52.8		3.2	310	3.80
12:20		97	52.8		3.2	320	3.80
12:35		96	56.6		3.4	310	3.80
		2nd	Test	301 mat			
1:50		98	49.6		2.4	300	2.60
2:05		99	53.4		2.6	292	3.10
2:20		98	57.1		2.9	293	3.40
2:35		70	68.6		3.4	350	3.60
		3rd	Test	404	mat	100% CR.	
3:55		97	45.1		2.9	307	3.00
4:10		79	33.8		2.2	356	3.20
4:25		69	45.1		2.9	341	3.20
4:40		67	45.1		2.9	348	3.20

V. EQUIPMENT USED

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

A. The Lear Siegler PM-100 stack sampler with appropriate auxillary equipment and glassware. The train was set up according to the schematic on the nex page.

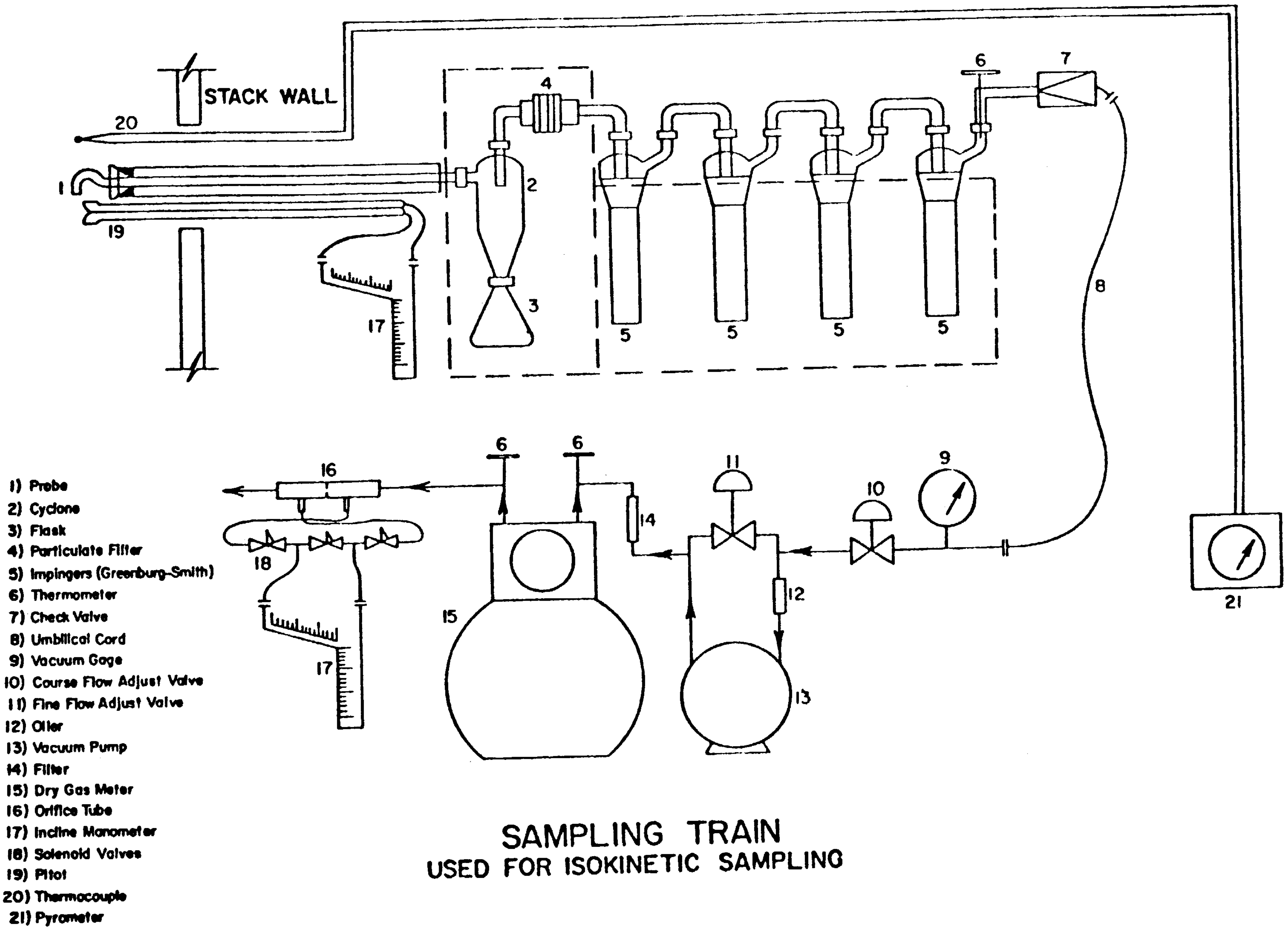
B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

C. Weston dial thermometers are used to check meter temperatures. An Analogic Model 2572 Digital Thermocouple is used for stack temperatures.

D. A Hays 621 Analyzer was used to measure the oxygen, carbon dioxide and carbon monoxide content of the stack gases. For non-combustion sources, A Bacharach Instrument Company Fyrite is used for the gas analysis.

E. Filters are mady by Schleicher and Schuell and are type 1-HV with a porosity of .03 microns.

F. The acetone is reagent grade or ACS grade with a residue of $\leq$ .001.



SAMPLING TRAIN
USED FOR ISOKINETIC SAMPLING

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

A. FILTERS: Fiberglass 4" sampling filters are prepared as follows:

Filters are removed from their box and numbered on the back side with a felt pen. The numbering system is continuous from job to job. The filters are placed in a desiccator to dry for at least 24 hours. Clean plastic petri dishes, also numbered, top and bottom, are placed in the desiccator with the filters. After desiccation, the filters are removed, one at a time, and weighed on the Sartorius analytical balance then placed in the correspondingly numbered petri dish. Weights are then recorded in the lab record books. Three filters are used for each complete particulate source emissions test and there should be several extra filters included as spares.

B. SILICA GEL: Silica Gel used for the test is prepared as follows:

Approximately 200 g of silica gel is placed in a wide mouth "Mason" type jar and dried in an oven at 175°C for two hours. The open jars are removed and placed in a desiccator until cool for two hours and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram. This weight is recorded for each sealed jar. The number of silica gel jars used is the same as the number of filters. Silica gel should be indicating type, 6-16 mesh.

II. Post - Testing Lab Analysis

A. FILTERS: The filters are returned to the lab in their sealed petri dishes. In the lab, the dishes are opened and placed into a desiccator for at least 24 hours. Then the filters are weighed continuously every six hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

B. SILICA GEL: The silica gel used in the stack test is returned to the appropriate mason jar and sealed for transport to the laboratory where it is reweighed to a constant weight on a triple beam balance to the nearest tenth of a gram.

C. PROBE RINSINGS: In all tests where a probe washout analysis is necessary, this is accomplished in accordance with procedures specified in "EPA Reference Method 5". These samples are returned to the lab in sealed mason jars for analysis. The front half of the filter holder is washed in accordance with the same procedures and included with the probe wash. Reagent or ACS grade acetone is used as the solvent. The backhalf of the filter holder is washed with deionized water into the impinger catch for appropriate analysis.

D. IMPINGER CATCH: In some testing cases, the liquid collected in the impingers must be analyzed for solid content. This involves a similar procedure to the probe wash solids determination, except that the liquid is deionized water.

E. ACETONE: A blank analysis of acetone is conducted from the one gallon glass container used in the field preparation. This acetone was used in the field for rinsing the probe, nozzle, and top half of the filter holder. A blank analysis is performed prior to testing on all new containers of acetone received from the manufacturer to insure that the quality of the acetone used will be exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter, it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. this laboratory procedure is taught by EPA in the "Quality Assurance for Source Emissions Workshop" at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to 0.1 mg and has a maximum capacity of 200 grams. The balance precision (standard deviation) is 0.05 mg. Before weighing an item, the balance should first be zeroed. This step should be taken before every series of weighings. To do this, the balance should have all weight adjustments at the "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to the full release position. The lighted vernier scale on the front of the cabinet should align with the "zero" with the mark on the cabinet. If it is not so aligned, the adjustment knob on the right hand side (near the rear of the cabinet) should be turned carefully until the marks align. Now return the beam arrest to the horizontal arrest position. The balance is now "zeroed".

To weigh an item, it is first placed on the pan. And the sliding doors are closed to avoid air current disturbance. The weight adjustment knob on the right hand side must be at "zero". The beam arrest is then slowly turned upward. The lighted scale at the front of the cabinet will now indicate the weight of the item in grams. If the scale goes past the divided area, the item then exceeds 100 g weight (about 3 1/2 ounces) and it is necessary to arrest the balance (beam arrest lever) and move the lever for 100 g weight away from you. It is located on the left hand side of the cabinet near the front, and is the knob closest to the side of the cabinet. The balance will not weigh items greater than 200 grams in mass, and trying to do this might harm the balance. Remember, this is a delicate precision instrument.

After the beam is arrested in either weight range, the procedure is the same. When the weight of the item in grams is found, "dial in" that amount with the two knobs on the left hand side (near the 100 g lever) color coded yellow and green. As you dial the weight, the digits will appear on the front of the cabinet. When the proper amount is dialed, carefully move the arrest lever down with a slow, steady turn of the wrist. The lighted dial will appear, and the right hand side knob (front of cabinet) is turned to align the mark with the lower of the two lighted scale divisions which the mark appears between. when these marks are aligned, the two lighted digits along with the two indicated on the right hand window on the cabinet front are fractional weight in grams (the decimal would appear before the lighted digits) and the whole number of grams weight is the amount "dialed in" on the left.

In general, be sure that the beam is in "arrest" position before placing weight on or taking weight off of the pan. Don't "dial in" weight unless the beam is arrested. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Valley

Sample Location hot mix asphalt plant

Blank volume (V_a) 200 ml

Date/Time wt. blank 4-24-85

Date/Time wt. blank 4-25-85

Relative humidity in lab 45 %

Density of Acetone (p_a) .7853 mg/ml

Gross wt. 95.6743 mg

Gross wt. 95.6737 mg

Ave. Gross wt. 95.6740 mg

Tare wt. 95.6737 mg

Weight of blank (m_{ab}) .0003 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a) (p_a)$ = (.0000019 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = (.0000018)(200)(.7853) = (.0003)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 4-24-85 Gross wt	g	94.6762	159.3000	159.2986
Date/Time of wt 4-25-85 Gross wt	g	94.6760	159.2997	159.2984
Average Gross wt	g	94.6761	159.2999	159.2985
Tare wt	g	94.4845	159.1758	159.1210
Less acetone blank wt (W_a)	g	.0003	.0003	.0003
Wt of particulate in acetone rinse (m_a)	g	.1913	.1238	.1772

Filter Numbers	#	BT-3216	BT-3217	BT-3218
Date/Time of wt 4-24-85 Gross wt	g	.5706	.5700	.5624
Date/Time of wt 4-25-85 Gross wt	g	.5701	.5700	.5620
Average Gross wt	g	.5704	.5700	.5622
Tare wt	g	.5242	.5281	.5328

Weight of particulate on filters(s) (m_f)	g	.0462	.0419	.0294
Weight of particulate in acetone rinse	g	.1913	.1238	.1772
Total weight of particulate (m_n)	g	.2375	.1657	.2066

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Remarks

Signature of analyst Kim Rea

Signature of reviewer

REFERENCE METHOD 3: GAS ANALYSIS BY FYRITE

FUEL	F_o FACTORS
WOOD	1.0540
BARK	1.0830
ANTHRACITE	1.0699
BITUMINOUS	1.1398
LIGNITE	1.0761
OIL	1.3465
GAS	1.7489
PROPANE	1.5095
BUTANE	1.4791

$O_2\% = 20.9 - [F_o \times CO_2\%]$

RUN #1: 13.33 = 20.9 - [1.7489 x 4.33]

RUN #2: 13.90 = 20.9 - [1.7489 x 4.0]

RUN #3 13.61 = 20.9 - [1.7489 x 4.17]

RUN 1:	$CO_{2\%}$	5.0	$CO_{2\%}$	3.5	$CO_{2\%}$	4.5	AVG.	4.33
	$O_{2\%}$	12.16	$O_{2\%}$	14.78	$O_{2\%}$	13.03	AVG.	13.33
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	
RUN 2:	$CO_{2\%}$	4.0	$CO_{2\%}$	4.5	$CO_{2\%}$	3.5	AVG.	4.0
	$O_{2\%}$	13.90	$O_{2\%}$	13.03	$O_{2\%}$	14.78	AVG.	13.90
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	
RUN 3:	$CO_{2\%}$	3.5	$CO_{2\%}$	4.0	$CO_{2\%}$	5.0	AVG.	4.17
	$O_{2\%}$	14.78	$O_{2\%}$	13.90	$O_{2\%}$	12.16	AVG.	13.61
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	

Form REC#8

(13)

SAMPLE ANALYTICAL DATA FORM

Plant Location Valley Backhalf

Relative humidity in lab ______ %

Sample Location ______

Density of Acetone (pa) .78 mg/ml

Blank volume (V_a) ______ ml

Date/Time wt. blank ______

Gross wt. ______ mg

Date/Time wt. blank ______

Gross wt. ______ mg

Ave. Gross wt. ______ mg

Tare wt. ______ mg

Weight of blank (m_{ab}) ______ mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a)(p_a) = ($ mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a = (\quad)(\quad)(\quad) = (\quad)$

		Run # 2	Run # 3	Run #
Acetone rinse volume (V_{aw})	ml			
Date/Time of wt 4-26-89 Gross wt	g	156.5750	162,1161	
Date/Time of wt 4-27-89 Gross wt	g	156,5750	162,1162	
Average Gross wt	g	156.5750	162,1162	
Tare wt	g	156.5658	162,1031	
Less acetone blank wt (W_a)	g	0	0	
Wt of particulate in acetone rinse (m_a)	g	0.0092	0.0131	

Filter Numbers	#			
Date/Time of wt ______ Gross wt	g			
Date/Time of wt ______ Gross wt	g			
Average Gross wt	g			
Tare wt	g			

Weight of particulate on filters(s) (m_f)	g			
Weight of particulate in acetone rinse	g			
Total weight of particulate (m_n)	g			

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Remarks ______

Signature of analyst Sam Turner

Signature of reviewer ______

VII. CALCULATIONS

VALLEY ASPHALT CORPORATION
SHARONVILLE, OHIO

SUMMARY OF TEST DATA

SAMPLING TRAIN DATA

		4-19-89 RUN #1	4-19-89 RUN #2	4-19-89 RUN #3
	start	11:40	13:58	15:55
	finish	12:59	15:01	16:58
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.1750	.1750	.1750
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000167	.000167	.000167
4. Isokinetic variation	I	93.6	93.7	97.7
5. Sample gas volume - meter cond., cf.	V_m	41.801	44.466	46.015
6. Average meter temperature, ^oR	T_m	533	533	535
7. Avg. oriface pressure drop, in. H_2O	dH	1.62	1.85	1.88
8. Total particulate collected, mg.	M_n	237.50	165.70	206.60

VELOCITY TRAVERSE DATA

		RUN #1	RUN #2	RUN #3
9. Stack area, ft^2.	A	7.75	7.75	7.75
10. Absolute stack gas pressure, in. Hg.	P_s	29.98	29.98	29.98
11. Barometric pressure, in. Hg.	P_{bar}	29.98	29.98	29.98
12. Avg. absolute stack temperature, R^o	T_s	688	666	662
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .81)	$-\sqrt{dP}$	1.93	1.98	1.99
14. Average stack gas velocity, ft./sec.	V_s	124.32	125.04	125.77

STACK MOISTURE CONTENT

		RUN #1	RUN #2	RUN #3
15. Total water collected by train, ml.	V_{ic}	276.00	265.00	302.00
16. Moisture in stack gas, %	B_{ws}	24.16	22.21	24.08

EMISSIONS DATA

		RUN #1	RUN #2	RUN #3
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	2022	2155	2129
18. Stack gas flow rate, cfm	acfm	57809	58144	58483
19. Particulate concentration, gr/dscf	C_s	0.0896	0.0588	0.0710
20. Particulate concentration, lb/hr	E	25.89	18.11	21.59
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000

ORSAT DATA

		RUN #1	RUN #2	RUN #3
22. Percent CO_2 by volume	CO_2	4.33	4.00	4.17
23. Percent O_2 by volume	O_2	13.33	13.90	13.61
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	82.34	82.10	82.22

Format: summryR3

Dry Gas Volume

$$V_{m(std)} = V_m \left[\frac{T_{(std)}}{T_m} \right] \left[\frac{P_{bar} + \frac{dH}{13.6}}{P_{(std)}} \right] = 17.64 \frac{^oR}{in.Hg} \; Y \; V_m \left[\frac{P_{bar} + \frac{dH}{13.6}}{T_m} \right]$$

Where:

$V_{m(std)}$ = Dry Gas Volume through meter at standard conditions, cu. ft.

V_m = Dry Gas Volume measured by meter, cu. ft.

P_{bar} = Barometric pressure at oriface meter, in. Hg.

P_{std} = Standard absolute pressure,(29.92 in. Hg.).

T_m = Absolute temperature at meter ^oR.

T_{std} = Standard absolute temperature (528^oR).

dH = Average pressure drop across oriface meter, in. H_2O.

Y = Dry gas meter calibration factor.

13.6 = Inches water per inches Hg.

RUN 1:

$$V_{m(std)} = (17.64)(.980)(41.801) \left[\frac{(29.98) + \frac{1.62}{13.6}}{533} \right] = 40.807 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.980)(44.466) \left[\frac{(29.98) + \frac{1.85}{13.6}}{533} \right] = 43.433 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.980)(46.015) \left[\frac{(29.98) + \frac{1.88}{13.6}}{535} \right] = 44.782 \text{ dscf}$$

Total Contaminants by Weight: GRAIN LOADING

Particulate concentration C_s' gr./dscf.

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{M_n}{V_{m(std)}} \right]$$

Where:

C_s' = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, gr./dscf.

M_n = Total amount of particulate matter collected, mg.

$V_{m(std)}$ = Dry gas volume through meter at standard conditions, cu. ft.

Run 1:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{237.50}{40.807} \right] = 0.0896 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{165.70}{43.433} \right] = 0.0588 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{206.60}{44.782} \right] = 0.0710 \text{ gr./dscf.}$$

Dry Molecular Weight

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%CO + \%N_2)$$

Where:

M_d = Dry molecular weight, lb./lb.-mole.

$\%CO_2$ = Percent carbon dioxide by volume (dry basis).

$\%O_2$ = Percent oxygen by volume (dry basis).

$\%N_2$ = Percent nitrogen by volume (dry basis).

$\%CO$ = Percent carbon monoxide by volume (dry basis).

0.264 = Ratio of O_2 to N_2 in air, v/v.

0.28 = Molecular weight of N_2 or CO, divided by 100.

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run 1:

$$M_d = 0.44(\ 4.33\%) + 0.32(13.33\%) + 0.28(\ .00\% + 82.34\%) = 29.23\ \frac{\text{lb}}{\text{lb-mole}}$$

Run 2:

$$M_d = 0.44(\ 4.00\%) + 0.32(13.90\%) + 0.28(\ .00\% + 82.10\%) = 29.20\ \frac{\text{lb}}{\text{lb-mole}}$$

Run 3:

$$M_d = 0.44(\ 4.17\%) + 0.32(13.61\%) + 0.28(\ .00\% + 82.22\%) = 29.21\ \frac{\text{lb}}{\text{lb-mole}}$$

Format: mdR3

Water Vapor Condensed

$$V_{wc_{std}} = \left[V_f - V_i \right] \left[\frac{p_w \; R \; T_{(std)}}{M_w \quad P_{(std)}} \right] = 0.04707 \left[V_f - V_i \right]$$

$$V_{wsg_{std}} = \left[W_f - W_i \right] \left[\frac{R \quad T_{(std)}}{M_w \quad P_{(std)}} \right] = 0.04715 \left[W_f - W_i \right]$$

Where:

0.04707 = Conversion factor, ft.^{3}/ml.

0.04715 = Conversion factor, ft.^{3}/g.

$V_{wc_{std}}$ = Volume of water vapor condensed (standard conditions), scf.

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel (standard conditions), ml.

$V_f - V_i$ = Final volume of impinger contents less initial volume, ml.

$W_f - W_i$ = Final weight of silica gel less initial weight, g.

p_w = Density of water, 0.002201 lb/ml.

R = Ideal gas constant, 21.85 in.Hg. (cu.ft./lb.-mole)($^{\circ}$R).

M_w = Molecular weight of water vapor, 18.0 lb/lb-mole.

T_{std} = Absolute temperature at standard conditions, 528°R.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

Run 1:

$V_{wc(std)} = (0.04707)(261.0) = 12.3$ cu.ft
$V_{wsg(std)} = (0.04715)(15.0) = 0.7$ cu.ft

Run 2:

$V_{wc(std)} = (0.04707)(245.0) = 11.5$ cu.ft
$V_{wsg(std)} = (0.04715)(20.0) = 0.9$ cu.ft

Run 3:

$V_{wc(std)} = (0.04707)(280.0) = 13.2$ cu.ft
$V_{wsg(std)} = (0.04715)(22.0) = 1.0$ cu.ft

Moisture Content of Stack Gases

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m_{std}}} \times 100$$

Where:

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

V_m = Dry gas volume measured by dry gas meter,(dcf).

$V_{wc_{std}}$ = Volume of water vapor condensed corrected to standard conditions (scf).

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel corrected to standard conditions (scf).

Run 1:

$$B_{ws} = \frac{12.3 + 0.7}{12.3 + 0.7 + 40.807} \times 100 = 24.16\ \%$$

Run 2:

$$B_{ws} = \frac{11.5 + 0.9}{11.5 + 0.9 + 43.433} \times 100 = 22.21\ \%$$

Run 3:

$$B_{ws} = \frac{13.2 + 1.0}{13.2 + 1.0 + 44.782} \times 100 = 24.08\ \%$$

Molecular Weight of Stack Gases

$$M_s = M_d (1 - B_{ws}) + 18 (B_{ws})$$

Where:

M_s = Molecular weight of stack gas, wet basis, (lb./lb.-mole).

M_d = Molecular weight of stack gas, dry basis, (lb./lb.-mole).

Run 1:

M_s = 29.23 (1 - 24.16) + 18 (24.16) = 26.52 (lb./lb.-mole)

Run 2:

M_s = 29.20 (1 - 22.21) + 18 (22.21) = 26.71 (lb./lb.-mole)

Run 3:

M_s = 29.21 (1 - 24.08) + 18 (24.08) = 26.51 (lb./lb.-mole)

Stack Gas Velocity

$$V_s = K_p \, C_p \left[\sqrt{dP} \right] \text{avg.} \sqrt{\frac{T_{s(avg.)}}{P_s \, M_s}}$$

Where:

V_s = Average velocity of gas stream in stack, ft./sec.

K_p = 85.49 ft/sec $\left[(g/g\text{-mole})\text{-}(mm\ Hg) \,/\, (^{o}K)(mm\ H_2O) \right]^{1/2}$

C_p = Pitot tube coefficient, (dimensionless).

dP = Velocity head of stack gas, in. H_2O.

P_{bar} = Barometric pressure at measurement site, (in. Hg).

P_g = Stack static pressure, (in. Hg).

P_s = Absolute stack gas pressure, (in. Hg) = $P_{bar} + P_g$

P_{std} = Standard absolute pressure, (29.92 in. Hg).

t_s = Stack temperature, (^{o}f).

T_s = Absolute stack temperature, (^{o}R). = 460 + t_s.

M_s = Molecular weight of stack gas, wet basis, (lb/lb-mole).

Run 1:

$$V = (85.49)\ (\ .81)\ (\ 1.93) \sqrt{\frac{688}{(29.98)(26.52)}} = 124.32 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .81)\ (\ 1.98) \sqrt{\frac{666}{(29.98)(26.71)}} = 125.04 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .81)\ (\ 1.99) \sqrt{\frac{662}{(29.98)(26.51)}} = 125.77 \text{ ft/sec.}$$

Stack Gas Flow Rate

$$Q_{sd} = 3600 \left[1 - B_{wc} \right] V_s \; A \left[\frac{T_{std}}{T_{stk}} \right] \left[\frac{P_s}{P_{std}} \right]$$

Where:

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr).

A = Cross sectional area of stack, (ft.^{2}).

3600 = Conversion factor, (sec./hr.).

t_s = Stack temperature, (^{o}f).

T_s = Absolute stack temperature, (^{o}R).

T_{std} = Standard absolute temperature, (528^{o}R).

P_{bar} = Barometric pressure at measurement site, (in.Hg.).

P_g = Stack static pressure, (in.Hg.).

P_s = Absolute stack gas pressure, (in.Hg.); = $P_{bar} + P_g$

P_{std} = Standard absolute pressure, (29.92 in.Hg.).

Run 1:

$$Q_{sd}=3600(1- \quad .2416 \quad)(124.32)(\quad 7.75) \left[\frac{528}{688} \right] \left[\frac{29.98}{29.92} \right] = 2022828.5 \; \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1- \quad .2221 \quad)(125.04)(\quad 7.75) \left[\frac{528}{666} \right] \left[\frac{29.98}{29.92} \right] = 2155791.1 \; \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1- \quad .2408 \quad)(125.77)(\quad 7.75) \left[\frac{528}{662} \right] \left[\frac{29.98}{29.92} \right] = 2129038.1 \; \frac{dscf}{hr}$$

Emissions Rate from Stack

$$E = \frac{(C_s)(Q_{sd})}{7000 \text{ gr./lb.}} = \text{lb. / hr.}$$

Where:

E = Emissions rate, lb/hr.

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, gr/dscf.

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscf/hr.

Run 1:

$$E = \frac{(0.0896)(2022828.5)}{7000} = 25.89 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0588)(2155791.1)}{7000} = 18.11 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0710)(2129038.1)}{7000} = 21.59 \text{ lb. / hr.}$$

Isokinetic Variation

$$I = 100\ T_s \left[\frac{0.002669\ V_{ic} + (V_m / T_m)\ (P_{bar} + dH / 13.6)}{60\ \theta\ V_s\ P_s\ A_n} \right]$$

Where:

I = Percent isokinetic sampling.
100 = Conversion to percent.
T_s = Absolute average stack gas temperature, ^{o}R.
0.002669 = Conversion factor, Hg - ft^3/ml - ^{o}R.
V_{ic} = Ttl vol of liquid collected in impingers and silica gel, ml.
T_m = Absolute average dry gas meter temperature, ^{o}R.
P_{bar} = Barometric pressure at sampling site, (in. Hg).
dH = Av pressure differential across the oriface meter, (in.H_2O).
13.6 = Specific gravity of mercury.
60 = Conversion seconds to minutes.
θ = Total sampling time, minutes.
V_s = Stack gas velocity, ft./sec.
P_s = Absolute stack gas pressure, in. Hg.
A_n = Cross sectional area of nozzle, ft^2.

Run 1:

$$I = (100)(\ 688\ ) \left[\frac{(0.002669)(276.00) + \frac{41.801}{533} \left[29.98 + \frac{1.62}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 124.32\ )\ (\ 29.98\ )\ (\ .000167\ )} \right] = 93.6\%$$

Run 2:

$$I = (100)(\ 666\ ) \left[\frac{(0.002669)(265.00) + \frac{44.466}{533} \left[29.98 + \frac{1.85}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 125.04\ )\ (\ 29.98\ )\ (\ .000167\ )} \right] = 93.7\%$$

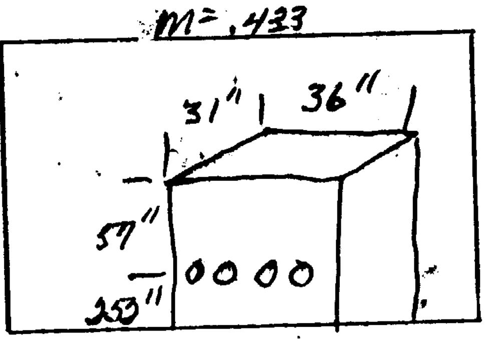
Run 3:

$$I = (100)(\ 562\ ) \left[\frac{(0.002669)(302.00) + \frac{46.015}{535} \left[29.98 + \frac{1.88}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 125.77\ )\ (\ 29.98\ )\ (\ .000167\ )} \right] = 97.7\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant VALLEY ASPHALT
Location CINN, OHIO
Operator DALE ARMSTRONG
Date 4-19-89
Run No. 1
Sample Box No. B2
Meter Box No. 620775 / C-185
Meter H @ 1.91
C Factor .980
Pitot Tube Coefficient Cp .810



Schematic of Stack Cross Section

Ambient Temperature 62
Barometric Pressure 29.98
Assumed Moisture, % 30
Probe Length, m(ft) 4.5
Nozzle Identification No. .ccc1670
Avg. Calibrated Nozzle Dia., (in.) .1257/.125/.125
Probe Heater Setting 5
Leak Rate, m3/min. (cfm) ∓.002 @ 3"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in. Hg) ∓.10
Filter No. BT-326

	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	461	530.00
INITIAL	200	515.00
DIFFERENCE	261	15.00

TRAV. PT NO.	SAMPLING TIME (θ)min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	11:40 / 11:43	2	226	3.5	1.5	605.600 / 607.59	66	62	270	60
2	11:46	2	226	3.7	1.6	609.60	72	60	275	60
3	11:49	2	226	3.4	1.5	611.58	74	60	260	60
4	11:52	2	226	3.4	1.5	613.53	76	60	260	60
5	11:55	2	224	3.1	1.3	615.48	78	60	270	60
B 1	11:56 / 11:59	2	230	4.0	1.7	617.59	78	64	275	60
2	12:02	2.5	230	4.2	1.8	619.89	82	64	260	60
3	12:05	2.5	230	4.1	1.8	622.01	84	64	245	60
4	12:08	2.5	230	4.4	1.9	624.24	84	64	240	60
5	12:11	2.5	230	4.1	1.8	626.45	84	66	240	60
C 1	12:12 / 12:15	2	230	3.9	1.7	628.54	82	66	230	60
2	12:18	2	232	4.0	1.7	630.66	84	66	230	60
3	12:21	2	230	3.9	1.7	632.79	86	66	250	60

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-19-89 LOCATION Cinn. Ohio TEST NO. 1

power →

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
12:37 / 12:40 4	~~12:34~~	2	224	3.9	1.7	635.48	80	74	230	60
5	12:43	2	228	3.6	1.6	637.23	84	72	250	60
D 1	12:44 / 12:47	2	226	3.1	1.4	639.19	82	70	250	60
2	12:50	2	226	3.5	1.5	641.21	82	70	255	60
3	12:53	2	228	3.5	1.5	643.41	84	70	200	60
4	12:56	2.5	228	3.6	1.6	645.27	84	70	225	60
5	12:59	2.5	226	3.6	1.6	647.401	84	70	260	60

RAMCON ENVIRONMENTAL CORPORATION

Plant VALLEY ASPHALT

m = .471

Location CINN. OHIO
Operator DAVE ARMSTRONG
Date 4-19-89
Run No. 2
Sample Box No. 1
Meter Box No. 670776 / C-185
Meter H @ 1.91
C Factor .980
Pitot Tube Coefficient Cp .810

Ambient Temperature 62
Barometric Pressure 29.98
Assumed Moisture, % 25
Probe Length, m(ft) 4 FT.
Nozzle Identification No. .0001670
Avg. Calibrated Nozzle Dia., (in.) .125/.125/.125
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) ±.000 @ 4"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in.Hg) +.10
Filter No. BT-3217/1

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL	445	563.00
INITIAL	200	543.00
DIFFERENCE	245	20.00

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ)min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	1:58 / 2:01	2	198	3.4	1.6	647.550 / 649.63	68	66	275	60
2	2:04	2	196	3.5	1.6	651.72	76	64	275	60
3	2:07	2	202	3.8	1.8	653.92	80	64	275	60
4	2:10	2	200	4.0	1.9	656.17	80	64	275	60
5	2:13	2.5	198	3.9	1.8	658.40	82	64	275	60
B 1	2:14 / 2:17	2	204	3.4	1.6	660.49	80	62	275	60
2	2:20	2.5	206	4.1	1.9	662.76	82	64	275	60
3	2:23	2.5	200	4.1	1.9	665.03	84	64	275	60
4	2:26	2.5	208	4.2	2.0	667.32	84	64	275	60
5	2:29	2.0	210	3.6	1.7	669.47	84	64	275	60
C 1	2:30 / 2:33	2.5	210	4.1	1.9	671.73	82	64	275	60
2	2:36	2.5	212	4.3	2.0	674.04	84	64	275	60
3	2:39	2.5	212	4.3	2.0	676.35	86	64	275	60

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-19-89 LOCATION Cinn. Ohio TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
4	2:42	2.5	210	4.2	2.0	678.68	86	64	275	60
5	2:48	2.5	210	4.1	1.9	680.97	86	64	275	60
D 1	2:46 2:49	2	208	3.1	1.5	682.92	82	64	275	60
2	2:52	2	210	3.7	1.7	685.04	84	64	275	60
3	2:55	3	206	4.4	2.1	687.41	86	64	278	60
4	2:58	3	208	4.4	2.1	689.75	86	64	275	60
5	3:01	3	214 ~~208~~	4.1	1.9	692.016	86	64	275	60

RAMCON ENVIRONMENTAL CORPORATION

m=.471

Plant VALLEY ASPHALT
Location CINN. OHIO
Operator DAVE ARMSTRONG
Date 4-19-89
Run No. 3
Sample Box No. 1
Meter Box No. 670775 / C-185
Meter H @ 1.91
C Factor .980
Pitot Tube Coefficient Cp .816

Ambient Temperature 62° F
Barometric Pressure 29.98
Assumed Moisture, % 25
Probe Length, m(ft) 4 FT.
Nozzle Identification No. .0001670
Avg. Calibrated Nozzle Dia., (in.) .175/.175/.175
Probe Heater Setting 5
Leak Rate, m3/min. (cfm) ±.000 @ 4"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in.Hg) +.10
Filter No. BT-3218

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	480	540.00
INITIAL	200	518.00
DIFFERENCE	280	22.00

Schematic of Stack Cross Section

TRAV. PT NO.		SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
							692.201				
A	1	3:55 / 3:58	2	190	3.1	1.5	694.17	66	62	275	60
	2	4:01	2.5	196	4.8	2.1	696.44	80	64	275	60
	3	4:04	2.5	202	4.6	2.2	699.17	80	64	275	60
	4	4:07	2.5	208	4.6	2.2	702.64	84	64	275	60
	5	4:10	2.5	196	4.4	2.[illegible]	704.60	86	64	275	60
B	1	4:11 / 4:14	2	200	3.6	1.7	706.49	86	64	275	60
	2	4:17	2.5	198	4.5	2.1	708.77	86	64	275	60
	3	4:20	2.5	202	4.7	2.2	711.19	86	64	275	60
	4	4:23	2.5	196	4.6	2.2	713.67	86	64	275	60
	5	4:26	2.5	206	4.3	2.0	716.02	88	66	275	60
C	1	4:27 / 4:30	2.5	200	3.9	1.8	718.45	86	64	275	60
	2	4:33	2.5	204	4.0	1.9	720.57	86	66	275	60
	3	4:36	2.5	204	4.0	1.9	722.86	88	66	275	60

3D

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-19-89 LOCATION Cinn, Ohio TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft³)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	4:39	3	210	4.0	1.9	725.18	88	66	275	60
5	4:42	2.5	208	3.6	1.7	727.41	88	66	275	60
D 1	4:43 4:46	2	202	3.2	1.5	729.37	86	66	275	60
2	4:49	2.5	200	3.4	1.6	731.58	88	66	275	60
3	4:52	2.5	204	3.4	1.6	733.81	88	66	275	60
4	4:55	2.5	208	3.6	1.7	735.99	88	68	275	60
5	4:58	2.5	202	3.5	1.6	738.216	88	68	275	60

IX. CALIBRATIONS

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 4-3-89 Meter box number C-185 Plant HARDAWAY Co.

Barometric pressure, P_b = 29.89 in. Hg Dry gas meter number 670775 Pretest Y .987

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average[a] (t_d), °F				
1.3	10	208.900 219.424	70	96 96	70 70	83	16.82	5	.971	
1.4	10	199.250 208.748	70	96 96	70 70	83	16.52	5	.972	
1.5	10	186.00 196.170	70	96 96	70 70	83	15.30	5	1.00	
									Y = .981	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest $Y \pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Date 2-10-88 Thermocouple number Outlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	ICE BATH	33° F	32° F	.03%
B	OVEN	152° F	150° F	.01%
C	OVEN	175° F	175° F	0%
D	Ambient	55° F	55° F	0%
	4-19-89	- 62°F	62°F	0%

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

Figure 2.5 stack temperature sensor calibration data form.

Date 2-10-88 Thermocouple number Inlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, ~~°C~~	Thermocouple Potentiometer Temperature, ~~°C~~	Temperature Difference,[c] %
A	ICE BATH	33°F	33°F	0%
B	OVEN	150°F	151°F	.007%
C	OVEN	175°F	173°F	.01%
D	AMBIENT	55°F	54°F	.02%
	4-19-89	62°F	62°F	0%

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

Figure 2.5 stack temperature sensor calibration data form.

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date ____________ Signature ____________

Nozzle No.	Average Diameter	Nozzle No.	Average Diameter
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 41 Date 2-3-88

Calibrated by: Sam T. Turner

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(A)$
1	0.90	1.37	.811	< .01
2	0.60	.91	.812	< .01
3	0.41	.62	.806	< .01
		$\bar{C}_p$ (SIDE A)	.810	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp(s) cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(B)$
1	0.90	1.38	.808	< .01
2	0.60	.92	.808	< .01
3	0.41	.62	.807	< .01
		$\bar{C}_p$ (SIDE B)	.808	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3}\left|C_p(s)-\bar{C}_p(\text{A OR B})\right|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

$$\left|\bar{C}_p(\text{SIDE A})-\bar{C}_p(\text{SIDE B})\right| \leftarrow \text{MUST BE} \leq 0.01$$

$$C_{p(s)} = C_{p(std)}\sqrt{\frac{\Delta p\ std}{\Delta p_s}}$$

Form No. EED-17-1

RAMCON

Lear Siegler Stack Sampler

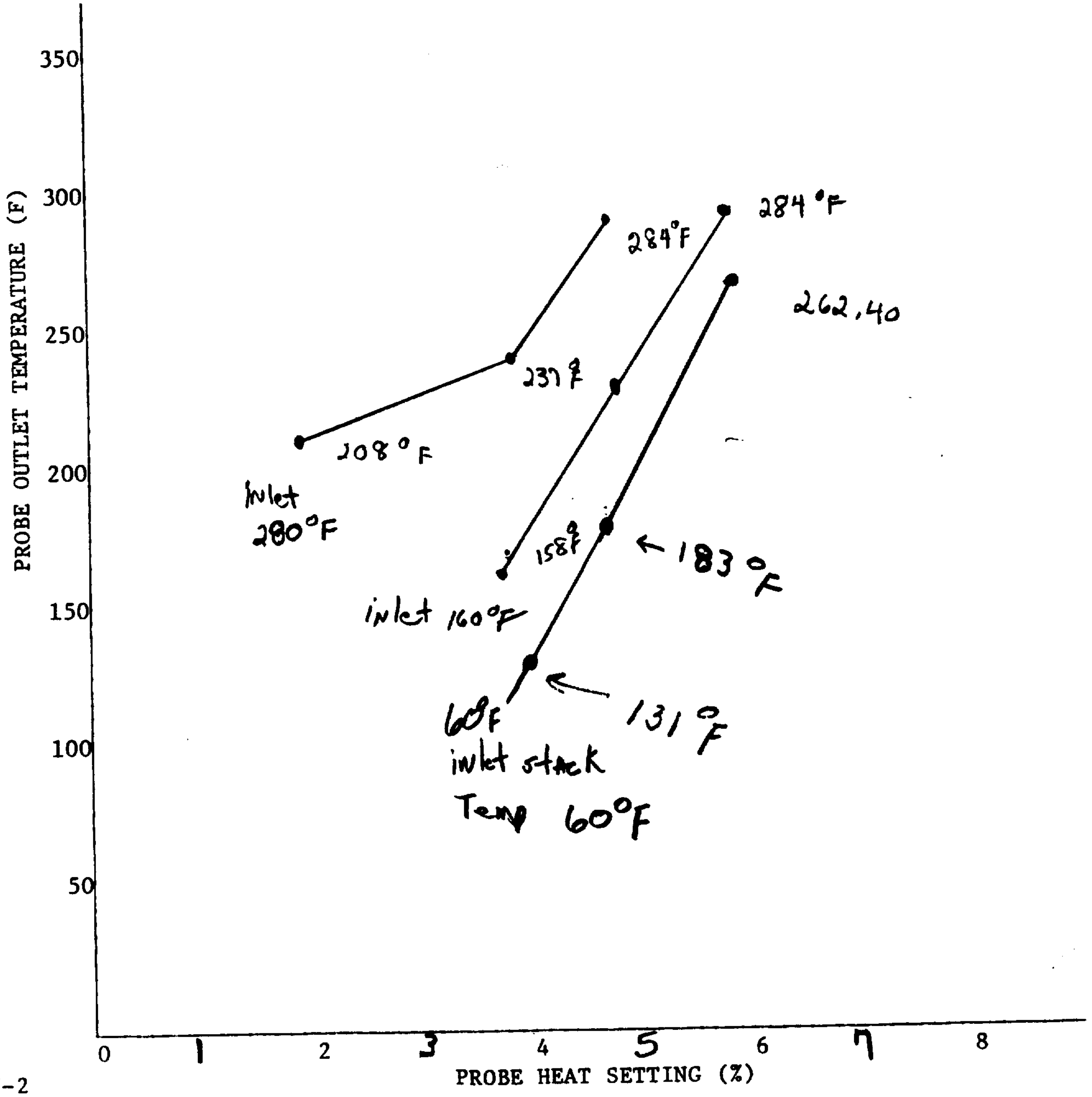
Heating Probe Calibration

Probe No. 41 Probe Length 4'

Date of Calibration 1-21-88 Signature Sam T. Turner

Name of Company to be tested

Note: 3 ft. probe - 5 min. warmup
6 ft. probe - 15 min. warmup
10 ft. probe - 30 min. warmup
Calibration flow rate = .75 CFM



Date 2-9-88 Thermocouple number 41

Ambient temperature 54 °C Barometric pressure 29.95 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	Ice Water	32° F	31°F	.03%
B	Boiling Water	212°F	211°F	.005%
C	Oil	380°F	377°F	.008%
D	Ambient	54°F	53°F	.02%
	4-19-89	62°F	62°F	0%

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$$

Figure 2.5 stack temperature sensor calibration data form.

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

Sumner Buck is the President of RAMCON Environmental Corporation. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutant's" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a certified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 47 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Dave Armstrong - Team Leader

Dave Armstrong has been with RAMCON Environmental for two years. He was promoted to Team Leader in 1988 and altogether has sampled almost 200 stacks of all types. Dave is a current V.E. reader and has extensive training in EPA Methods 1 - 9.